TECHNOLOGY

Did you know?
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One Million Pixel Infrared Detector May Have Numerous Applications

A Quantum Well Infrared Photodetector (QWIP) array, developed by a NASA-led team with funding by the Earth Science Technology Office, can now see invisible infrared light in a range of "colors," or wavelengths. The detector is the world's largest infrared detector technology that can sense infrared over a broad range.

A false color image of a Goddard engineer in the far infrared (8-12 micrometer IR spectral band) taken with the 1 megapixel GaAs QWIP camera. Warmer temperatures are orange, cooler temperatures are dark red. Notice the thermal handprint left on her lab coat as she removes her hand from her pocket. Credit: NASA Print-resolution image (200 K jpg image)

"The ability to see a range of infrared wavelengths is an important advance that will greatly increase the potential uses of the QWIP technology," said Dr. Murzy Jhabvala of NASA's Goddard Space Flight Center, Greenbelt, Md., Principal Investigator for the project. The QWIP detector can see infrared between 8 to 12 micrometers.

The QWIP detector is a Gallium Arsenide (GaAs) semiconductor chip with over 100 layers of detector material on top. The layers are thin, ranging from 10 to 700 atoms thick, and are designed to act as quantum wells. Quantum wells trap electrons so that only light with a specific energy can release them. If light with the correct energy hits one of the quantum wells in the array, the freed electron flows through a separate chip above the array, called the silicon readout, where it is recorded. A computer uses this information to create an image of the infrared source.

Unlike a simple photograph that just shows the appearance of an object, spectroscopy is used to gather more detailed information like the object's chemical composition, speed, and direction of motion. Potential applications include: studying troposphere and stratosphere temperatures and identifying trace chemicals; tree canopy energy balance measurements; measuring cloud layer emissivities, droplet/particle size, composition and height; SO2 and aerosol emissions from volcanic eruptions; tracking dust particles (e.g., from the Sahara Desert); CO2 absorption; coastal erosion; ocean/river thermal gradients and pollution; analyzing radiometers and other scientific equipment used in obtaining ground truth and atmospheric data acquisition; ground based astronomy; and temperature sounding.

Other possible applications for QWIP arrays include: location of forest fires and residual warm spots; location of unwanted vegetation encroachment; monitoring crop health; monitoring food processing contamination, ripeness, and spoilage; locating power line transformer failures in remote areas; monitoring effluents from industrial operations such as paper mills, mining sites, and power plants; infrared microscopy; searching for a wide variety of thermal leaks, and locating new sources of spring water.

The QWIP arrays are relatively inexpensive because they can be fabricated using standard semiconductor technology that produces the silicon chips used in computers everywhere. They can also be made very large, because GaAs can be grown in large ingots, just like silicon.

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